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**Date** 11 May 2006

Dear Katherine,

**Carbon capture and storage: A consultation on barriers to commercial deployment**

EDF Energy welcomes the opportunity to respond to the HM Treasury consultation on barriers to commercial deployment of carbon capture and storage.

Diversity in UK electricity generation is essential to maximize security of supply. Through reducing CO<sub>2</sub> emissions by up to 90%, carbon capture and storage (CCS) has the potential to support fuel diversity in the medium to longer-term by enabling the large-scale retention of coal in the electricity generation mix whilst providing a major contribution to the UK's CO<sub>2</sub> emission reduction goal of 60% by 2050.

The key technical challenges are:

- the integration of CCS components into cost-effective processes on the scale required to abate emissions from fossil fuel plant; and
- the successful demonstration of the safe containment of CO<sub>2</sub> in a storage facility to enable public acceptance of CCS technology and commercialisation.

The key regulatory challenges are:

- the UK government must secure international agreement that CCS projects, both with and without Enhanced Oil Recovery, are legally permissible;

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- the reduction in CO<sub>2</sub> emissions when placing CO<sub>2</sub> into storage must be recognised when calculating the emissions of fossil plant or other CO<sub>2</sub> emitting industrial installations under the EU ETS;
- the storage operator and/or injector must be liable for CO<sub>2</sub> emission releases until the facility is formally declared closed with the CO<sub>2</sub> successfully contained. The long-term storage of CO<sub>2</sub> has similar characteristics to long-term storage of nuclear waste – the residual risks and any resultant liability could outlive the duration of the commercial entity (the original producer or storage operator). The liability for residual risks can be offset by a payment per tonne of CO<sub>2</sub> placed in a storage facility, which is held in a liabilities fund against future costs;
- the requirement for a comprehensive regulatory framework for transportation of CO<sub>2</sub> is likely to be limited in the short-term as projects will be bespoke and utilise converted, existing infrastructure. However in the medium to long-term the requirement for access by third parties to CO<sub>2</sub> transportation pipelines and storage facilities will increase if there is to be deployment of CCS on a large scale and there will then be a requirement for an appropriate regulatory regime; and
- a health and safety framework and environmental regulatory framework for CCS operations will be needed. Preliminary work to develop this could usefully be undertaken now to prevent delays later in the process.

In terms of support required for CCS we consider there to be two discrete phases:

- a development phase in which a small number of projects are provided with direct financial support to demonstrate the technical viability of CCS; and
- a second phase in which “commercial” CCS projects compete, on a level playing field, with other forms of low CO<sub>2</sub> generation in a competitive market. In our response to the Energy Policy Review, we proposed a mechanism for underpinning a minimum value for carbon efficiency over the economic life of an investment to overcome defects in the structure of the EU ETS with respect to long-term investments.

We provide more detail on our carbon contract mechanism and on selected specific questions asked within the consultation below.

Yours sincerely,



**Denis Linford**  
**Director of Regulation**

## **Attachment**

EDF Energy's response to questions raised in 'a consultation on barriers to commercial deployment of carbon capture and storage'.

Paragraph numbers refer to questions in consultation paper.

### **1.32 Potential carbon reductions**

Stack CO<sub>2</sub> emissions from new highly efficient coal plant fitted with CCS are likely to be of the order of c. 0.1 tonnes CO<sub>2</sub> / MWh assuming 85% CO<sub>2</sub> removal. Although higher than full life-cycle emissions from renewables and nuclear (<0.05 tonnes CO<sub>2</sub> / MWh) this performance still compares very favourably with emissions from unabated fossil technologies including CCGT's using natural gas (c. 0.35 tonnes CO<sub>2</sub> / MWh stack emissions).<sup>1</sup> Fossil plant using CCS should be considered as a low carbon generation technology.

Energy efficiency technologies can also provide cost effective reductions in carbon emissions. However EDF Energy believes that even with a major energy efficiency programme that UK electricity demand is likely to increase - and may increase significantly in the longer-term if alternative uses for electricity are found (e.g. production of hydrogen for transport, large-scale deployment of ground source heat pumps, etc).

To maintain diversity within the electricity generation mix and increase security of supply there is likely to be a role for a range of different technology options for CO<sub>2</sub> abatement, not just the most CO<sub>2</sub> efficient technology.

### **1.34 Technology**

No comment

### **1.35 Engineering and manufacturing capability**

No comment

### **1.41 Regulation, liability and public acceptance**

CCS transport networks and storage facilities are likely to be characterized by relatively few users – and it seems unlikely that all transportation pipelines will be owned / operated by the same company, particularly as some may be re-used, upgraded existing oil and gas infrastructure. Due to the limited number of users a practical approach could be to combine the shipper-transporter role.

The sort of framework used to regulate shrinkage (which includes leakage) in NGG's gas transportation network with a target, cap and collar and sharing factors which smears part of the cost/benefit of performance across shippers (and ultimately consumers) is unlikely to be appropriate.

Instead, it would seem sensible for short-term liability for CO<sub>2</sub> emissions at different points in the CCS process to reside with the operator of that component of the process.

- Emissions before CO<sub>2</sub> entering a third-party operated transportation network should be the liability of the CO<sub>2</sub> producing installation;

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<sup>1</sup> Sources: IAEA, OECD Nuclear Energy Agency, EDF Energy analysis

- leakage from a managed pipeline network should be the liability of the shipper-transporter; and
- leakage from a storage facility before it is declared closed must be the liability of the storage operator.

In practice this is likely to mean that title to the CO<sub>2</sub> is transferred to the operator of each component of the CCS process.

#### **1.48 Cost**

No comment

#### **1.54 Economic incentives for CCS**

The main developing indicator of the value of low carbon energy is the EU Emissions Trading Scheme (ETS). This mechanism should stimulate carbon reductions in the most economic way and sequestered CO<sub>2</sub> should be considered as not having been emitted from a combustion installation for the purposes of measurement under the EU ETS. However, as presently designed, ETS does not provide long-term signals for investment. The present time periods for which caps have been set are too short and there is no certainty concerning long-term parameters. Therefore carbon price forecasts cannot be taken into account when evaluating investments. In view of this, and to reflect the value it places on longer term carbon reductions, the government should create a long-term market mechanism that will complement ETS and stimulate investment in low carbon technologies, including CCS. This would create a more level playing field for low carbon technologies.

The mechanism EDF Energy proposes would essentially need to underpin a minimum value for carbon efficiency over the economic life of an investment; there might also need to be a cap and collar approach in setting this value. The liability on the government, which might alternatively be placed on customers, should in practice be fully offset by the market price of carbon, which ETS should provide over time. This liability should in any case be set against the real and increasing liability faced by the government if action to address climate change is not taken.

Carbon contracts have the ability to reinforce and strengthen carbon market mechanisms even where, like the current EU ETS, the market mechanism alone does not produce the necessary long-term price signals. The contract gives investors the long term certainty they need, without requiring the government to pick technologies and can be designed to be consistent with existing policy mechanisms. Such contracts have the further advantage of allowing Government to limit its liabilities under these contracts by controlling the volume of abatement it is willing to underwrite. The government can further limit its liabilities by influencing wider policy development and retaining the carbon price within a reasonable range that minimises its financial exposure. This liability should in any case be set against the real and increasing liability faced by the government if action to address climate change is not taken. A possible problem with a carbon contract is that if the price for carbon remains high, through the EU ETS, then a payment through the contract will be in addition to the carbon element of the electricity price. The solution to this is to contract only for the difference between the contract price and market price for carbon.

A contract for difference is essentially providing a 'floor price' for carbon. If a strong EU ETS phase 3 emerges from international negotiation, as the government intends, the value of carbon will remain an important factor of the electricity market. A carbon price

will mean that the cost of carbon is properly reflected in electricity prices according to the level of emissions associated with the production of that electricity. In these circumstances the government would not need to make any payments to the investor, as the investor is already benefiting through the wholesale price for electricity. Only if the price for carbon falls to a low point would the government become liable for payments. Companies wishing to bid for such contracts would competitively bid to the government, so that the level of the floor would be pushed down to the lowest level needed to secure the desired reduction in CO<sub>2</sub> emissions. Such a bidding process should be open to all forms of low carbon generation and be 'technology neutral'. The government would then have the option of contracting for as much or as little carbon reduction as required to fit with the overall carbon reduction goals.

Carbon contracts are clearly an appropriate support mechanism in which mature technologies can compete to deliver cost-effective CO<sub>2</sub> emission reductions. We recognise that additional support is appropriate and necessary for technologies such as CCS that are in an early stage of development. Such mechanisms should however seek value for money. One approach would be for government to issue a tender for prospective CCS projects and award funding to those with the greatest technical merit and cost-effectiveness.

Further details on our proposal for carbon contracts are provided in our Energy Policy Review response.

EDF Energy  
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